

REMARKS

Claims 1-30 were pending in this application. Claims 8-17 stand allowed. Claims 1-7 and 18-30 stand rejected. Claims 1-2, 18-19, 25, and 29 have been cancelled. Claims 3, 5, 7, 20, 22, 24, 26-28, and 30 have been amended. Claim 31 was added. Claims 3-17, 20-24, 26-28, and 30-31 remain in the application.

The specification was amended by adding some language taken from U.S. Patent No. 6,606,411, which was incorporated by reference in the application as filed, at page 4, lines 31-33. The added language is discussed below in relation to Claim 31.

Claims 1, 2, 18, 19, 25, 27, and 30 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 5,644,765 by Shimura et al.

Claims 1-2, 18-19, and 25 have been cancelled.

Claim 27 has been amended to depend from Claim 33 (discussed below).

The rejection stated in relation to Claim 30:

"Regarding claim 30, Shimura discloses and computing an indication of image content by dividing each image into a plurality of blocks and computing an indication of image content in each block (column 3, lines 33-35: the number of black pixels in each block is computed). The images (20 and 33, figure 2) utilized by Shimura are essentially foreground objects. Therefore, Shimura's blocks are assigned to foreground areas."

Claim 30 has been amended to state:

30. A method for detecting duplicate images comprising the steps of:

providing at least two images originally captured by a photographic camera at determinable times from original scenes;
computing an indication of image content for each image by dividing each image into blocks, computing an indication of image content in each block, and comparing the computed indication of image content in each corresponding block for the two images to generate a similarity metric for each block;

determining the time of original capture of each of the images; and

evaluating the similarity metric for each block and the time of original capture to determine whether the images are duplicate images;

wherein the step of computing an indication of image content further comprises assigning two or more blocks to represent a foreground area of the images, and computing an indication of image content in each block and in the foreground areas of each image.

Claim 30 is supported by the application as filed, notably, at page 5, lines 8-10.

Claim 30 requires assigning two or more blocks to represent a foreground area and computing an indication of image content in the foreground area. Shimura's blocks do not meet this language.

Claims 3-7 and 20-24 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Shimura in view of Mizoguchi and U.S. Patent 6,445,818 by Kim et al. ("Kim"). The rejection stated in relation to Claims 3-4 and 20-21:

"Regarding claims 3, 4, 20, and 21, Shimura and Kim do not expressly disclose dividing the images into 4x4, 3x3, or fewer blocks. However, at the time the invention was made, dividing an image into a small number of blocks and processing each block was common in the art and would have *been as obvious* modification to Shimura and Kim.

Official notice taken."

Claims 3 and 20 have been amended to state:

3. A method for detecting duplicate images comprising the steps of:

providing at least two images of an original scene captured at determinable times by a photographic camera, where the camera records a time of camera capture of the original scene;

computing an indication of image content for each image;
determining the time of camera capture of each of the images; and

evaluating the indication of image content and the time of camera capture to determine whether the images are duplicate images;

wherein the step of computing an indication of image content comprises:

dividing each image into blocks; and
computing an indication of image content in each block;
and

wherein each image is divided into 4x4 or 3x3 blocks.

20. A computer program product for detecting duplicate images comprising: a computer readable storage medium having a computer program stored thereon for performing the steps of:

providing at least two images of an original scene captured at determinable times by a photographic camera, where the camera records a time of camera capture of the original scene;

computing an indication of image content for each image;

determining the time of camera capture of each of the images; and

evaluating the indication of image content and the time of camera capture to determine whether the images are duplicate images;

wherein the step of computing an indication of image content comprises:

dividing each image into blocks; and

computing an indication of image content in each block;

and

wherein each image is divided into 4x4 or 3x3 blocks.

Both Claims 3 and 20 require that each image is divided into 4x4 or 3x3 blocks.

The application indicates that it was determined experimentally that 4x4 and 3x3 were superior to larger numbers of blocks and 2x2 blocks. (application, pages 6-9 generally) The application states:

"In order to benchmark and verify the algorithm, a third party ground truth database was set up. Four hundred forty three (443) pictures were carefully chosen from the database. The pictures are all duplicates candidates, including a lot of pictures that are obviously not duplicates for a human eye but might be for a machine readable apparatus (same picture but different people, etc.). The database contains about 270 pairs. The third party ground truth has been based on the participation of ten observers. Each observer was given a definition of what are duplicates

pictures plus some explanation of how to make a decision. {discussion of explanation to the observers continues}" (application, page 7, lines 4-12)
"The results of the comparison are shown in Figure 2. Figure 2 shows that the new approach with smaller blocks is better than a block-based histogram technique involving a larger number of blocks for the detection of duplicates. It also appears clear that the results of the 3x3 blocks and the 4x4 blocks approaches exceed the results of the 2x2 blocks approach."
(application, page 8, lines 2-7)

Even if it was obvious by official notice to use 4x4 or fewer blocks, it would not be obvious to use 4x4 or 3x3 blocks, and not 2x2 blocks. (Note the differences among the 4x4, 3x3, and 2x2 blocks graphed in Figure 2 of the application.)

Claims 4-7 and 21-24 and added Claims 31-32 are allowable as depending from Claims 3 and 20, respectively and as follows.

Claims 4 and 21 state:

4. The method as claimed in claim 3 wherein each image is divided into 3x3 blocks.

21. The computer program product as claimed in claim 20 wherein each image is divided into 3x3 blocks.

The advantages of 3x3 blocks are discussed in the application:

"We decided to use the 3x3 blocks approach for the following reasons: 1) the results are slightly better than with the use of 4x4 blocks; and 2) the 3x3 blocks approach has the advantage of having a middle block, which for the majority of the pictures is likely to contain the main subject."
(application, page 8, lines 7-11)

This is not within the teachings of the cited references.

Claim 31 states:

31. The method as claimed in claim 6 wherein the step of evaluating the indication of image content and the time of camera capture comprises comparing one or more blocks of one image, using a histogram intersection metric, to corresponding blocks of another image and using the time difference between capture of the two images to determine whether the images are duplicate images; and wherein the histogram intersection metric has the formula:

$$Inter(R, C) = \frac{\sum_{i=1}^n \min(R_i, C_i)}{\sum_{i=1}^n R_i}$$

where $Inter(R, C)$ is the histogram intersection metric, R is the histogram of a reference, C is the histogram of a candidate, and n is the number of bins.

Claim 31 is supported by the application as filed, notably, the original claims (particularly original Claim 6) and the paragraph of the specification changed in this amendment, which begins on page 4 at line 15. The cited references do not teach or suggest use of the recited metric.

Claim 32 states:

32. The method as claimed in claim 20 wherein two or more blocks represent a foreground area of the images; and
said computing further comprises computing an indication of image content in the foreground areas of each image.

Claim 32 is supported and allowable on the same basis as Claim 30.

Claims 28 and 29 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Shimura in view of Mizoguchi and U.S. Patent 6,163,622 by Abdel-Mottaleb et al. ("Abdul-Mottaleb"). The rejection stated:

"Regarding claim 29, Shimura discloses evaluating the similarity metric comprises comparing one or more blocks of one image to corresponding blocks of another image (32, figure 5 and 52, figure 2: the corresponding blocks (i.e. the computed indications) of the images are compared to generate similarity metric, which is evaluated to determine similarity between the images) and using the time difference between capture of the two images (figure 4, S16) to determine whether the images are duplicate images (i.e. whether the images are substantially similar with regards to the content of the image blocks and the time of registration).

Shimura discloses using "the number of black pixels in each of a plurality of blocks" (column 3, lines 33-35) to generate a similarity metric between the blocks but does not specifically disclose using a histogram intersection metric to compare the one or more blocks of the images.

Abdel-Mottaleb discloses a system that determines the similarity between images. In a method similar to that of Shimura, Abdel-Mottaleb divides the images into blocks and computes an indication of image content for each block (figure 3). The indications are histograms (316, 318, 320, and 322), which denote the numbers of like-colored pixels for each block. The histograms of corresponding blocks are then compared (120, figure 1) using a histogram intersection metric (equation (8), column 7) to determine the similarity (122) between the images.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Shimura and Mizoguchi by Abdel-Mottaleb to use a histogram similarity metric for comparing the image blocks since Shimura discloses that a count of black pixels for each block (which is essentially a histogram of the black pixels of each block) is used for comparing the blocks, and Abdel-Mottaleb teaches that, for the purposes of determining the similarity between two images, the number of like-colored pixels of corresponding blocks of the images are compared using a histogram intersection metric to achieve superior matching results (column 2, lines 12-30).

Claim 29 was cancelled and replaced by Claim 33, which states:

33 (new). A method for detecting duplicate images comprising the steps of:

providing at least two images originally captured by a photographic camera at determinable times from original scenes;

computing an indication of image content for each image by dividing each image into blocks, computing an indication of image content in each block, and comparing the computed indication of image content in each corresponding block for the two images to generate a similarity metric for each block;

determining the time of original capture of each of the images; and

evaluating the similarity metric for each block and the time of original capture to determine whether the images are duplicate images;

wherein the step of evaluating the similarity metric for each block and the time of capture comprises comparing one or more blocks of

one image, using a histogram intersection metric, $Inter(R,C)$, to corresponding blocks of another image and using the time difference between capture of the two images to determine whether the images are duplicate images;

wherein:

$$Inter(R,C) = \frac{\sum_{i=1}^n \min(R_i, C_i)}{\sum_{i=1}^n R_i}$$

where $Inter(R,C)$ is the histogram intersection metric, R is the histogram of a reference, C is the histogram of a candidate, and n is the number of bins.

Claim 33 is supported by the application as filed, notably original Claim 29 and the paragraph of the specification changed in this amendment, which begins on page 4 at line 15. The cited references do not teach or suggest use of the recited metric.

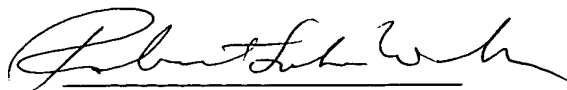
Claims 27-28 are allowable as depending from Claim 33.

Claim 26 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Shimura in view of Mizoguchi and U.S. Patent 4,143,956 by Miyagawa. Claim 26 is allowable as depending from Claim 33.

It is believed that these changes now make the claims clear and definite and, if there are any problems with these changes, Applicants' attorney would appreciate a telephone call.

In view of the foregoing, it is believed none of the references, taken singly or in combination, disclose the claimed invention. Accordingly, this application is believed to be in condition for allowance, the notice of which is respectfully requested.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Robert Luke Walker", written in black ink.

Attorney for Applicant(s)
Registration No. 30,700

Robert Luke Walker/amb
Rochester, NY 14650
Telephone: (585) 588-2739
Facsimile: (585) 477-1148